



Updates on U.S. Regional Wind Integration Studies



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Large Scale Integration of Wind Power into Power Systems
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Outline

- Overview of studies
- Wind Mesoscale Modeling
- Eastern Wind Integration and Transmission Study
- Western Wind and Solar Integration Study
- Summary

OVERVIEW

Why **regional** integration studies?

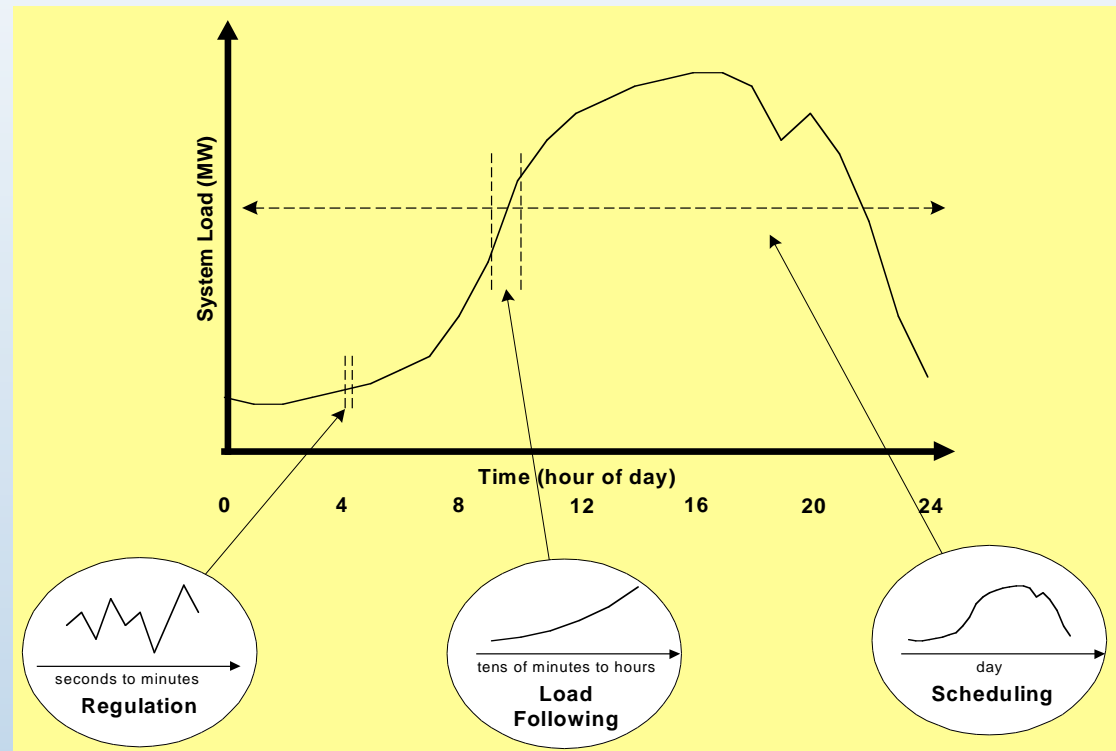
- DOE/NREL/AWEA's 20% Wind by 2030 Scenario
- Joint Coordinated System Plan increasing footprint
- Western Governor's Association Clean and Diversified Energy Initiative
- WestConnect's Virtual Control Area Study
- RPS targets in many states and rapid growth in wind power expected

Goals and Issues to Address

- Goals
 - To understand the costs and operating impacts due to the **variability** and **uncertainty** of 20-30% wind energy on the grid
 - Not the cost of wind energy
 - Not a cost/benefit analysis
 - Meaningful, broadly supported results through a technically rigorous, stakeholder-inclusive study process
- Issues
 - Does geographical diversity help?
 - How do local resources compare to out-of-state resources
 - Can balancing area cooperation help manage variability?
 - What is the benefit of wind forecasting?
 - How can hydro help with wind integration?

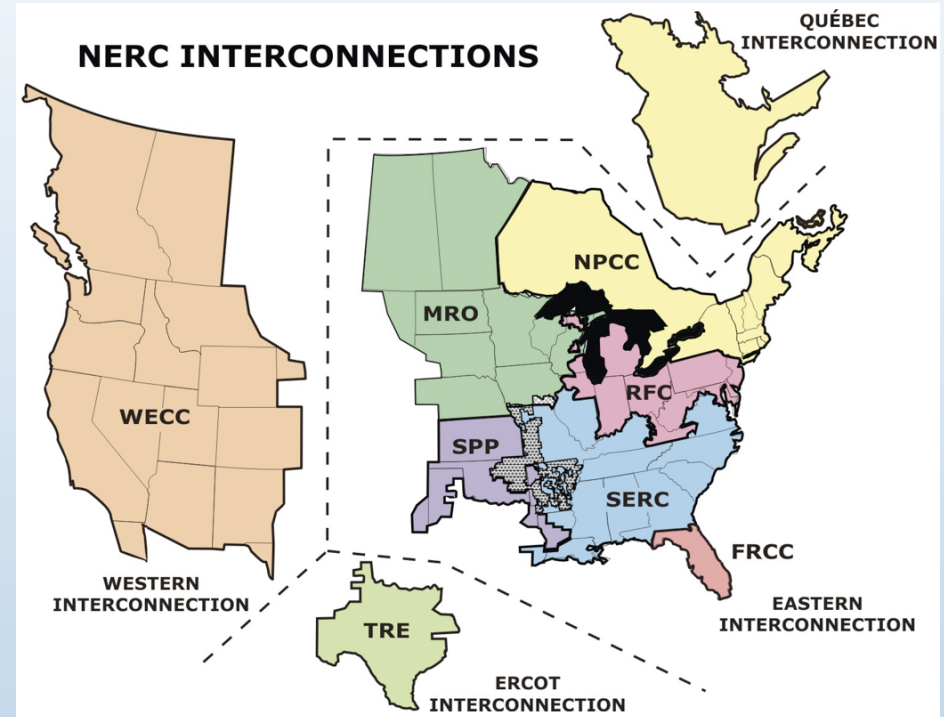
Integration Study - Key Tasks

- Evaluate operating impacts and associated costs
 - Regulation
 - Load Following
 - Unit Commitment
- Evaluate reliability impacts
 - Effective Load Carrying Capability/
Loss of Load Probability



Regional Studies

- Eastern Wind Integration and Transmission Study (EWITS)
- Western Wind and Solar Integration Study
- Scope of studies
 - Wind Mesomodeling
 - Integration Study
 - Simulate study year using load and climate patterns of 2004, 2005, 2006
 - Statistical analysis
 - EWITS includes transmission study

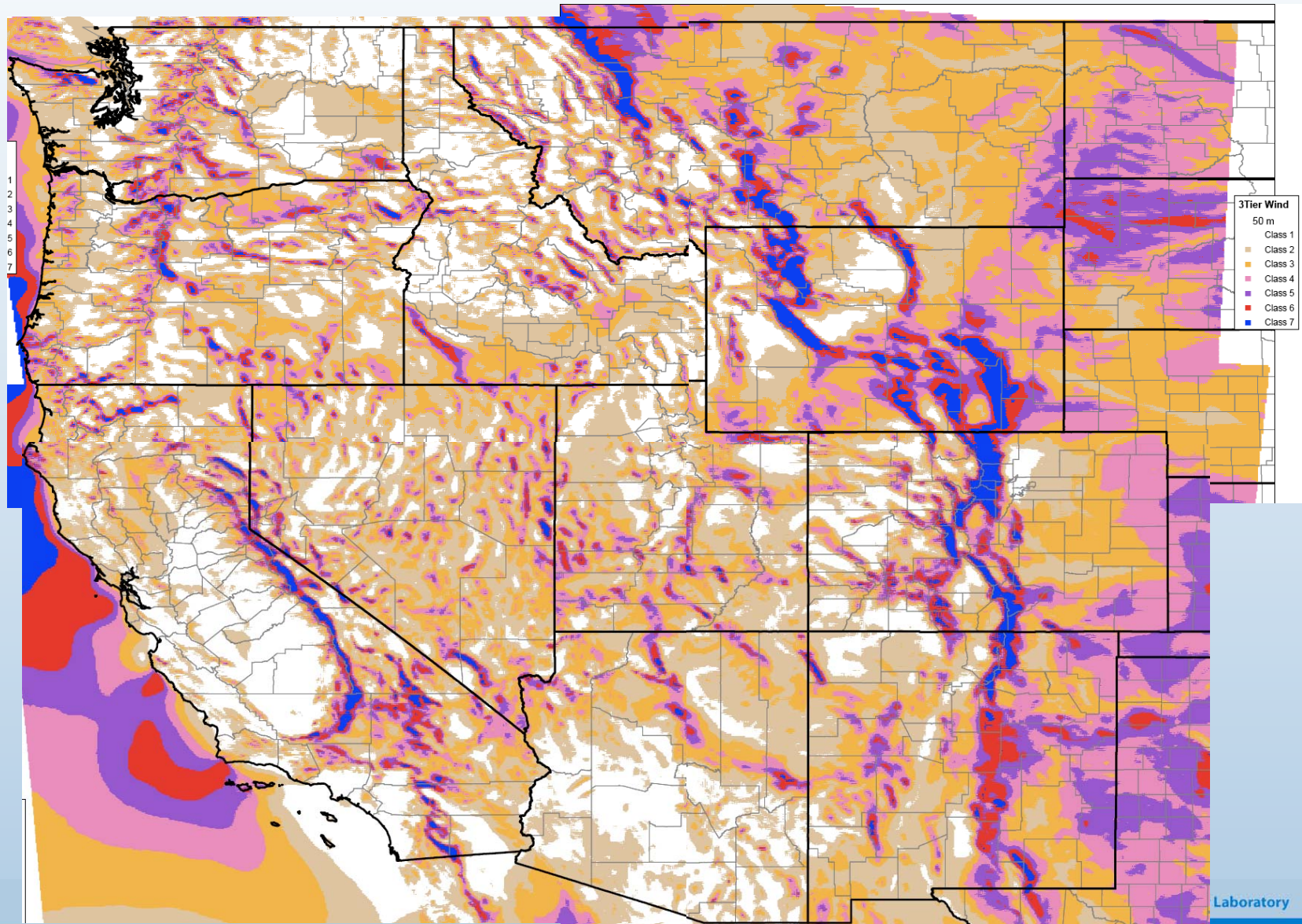


WIND MESOSCALE MODELING

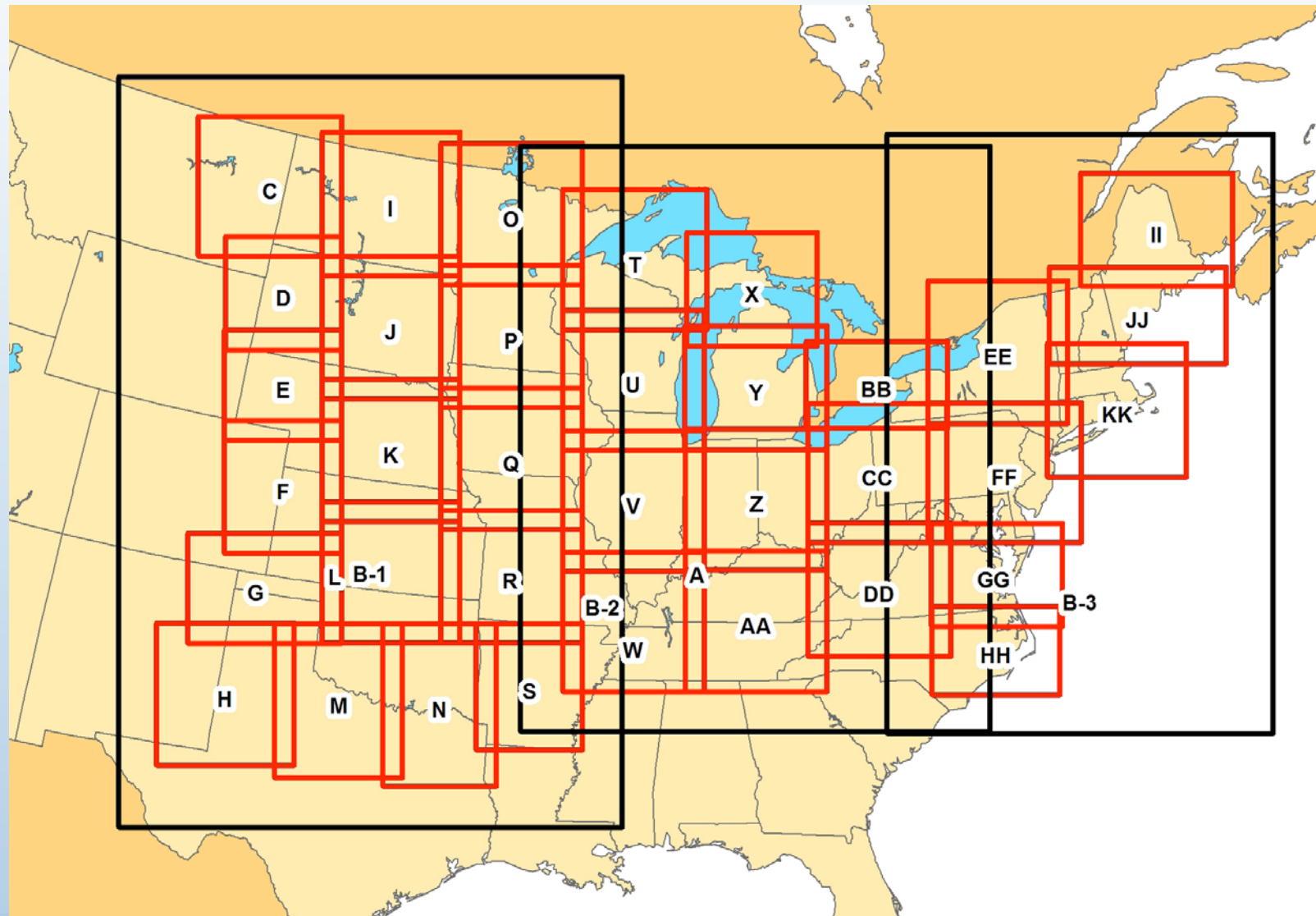
Wind Data

- Previous data sets assembled from various years, measurements and assumptions
- Hired 3TIER and AWS/Truewind for wind mesomodeling of west and east, respectively
- Wind speed database (10's of terabytes)
 - Most of US at 2km x 2km grid
 - 10, 20, 50, 100, and 200m hub heights
 - 10 minute intervals for 2004-6
- Wind power database (few terabytes)
 - Selected promising sites
 - Each grid points holds 30 MW
 - Based on Vestas V90 3MW turbine
 - Hourly forecast for day-ahead wind output

Western US – 2006 Wind Map



Nested Grid Cells for the Numerical Weather Model - Eastern Mesoscale Analysis

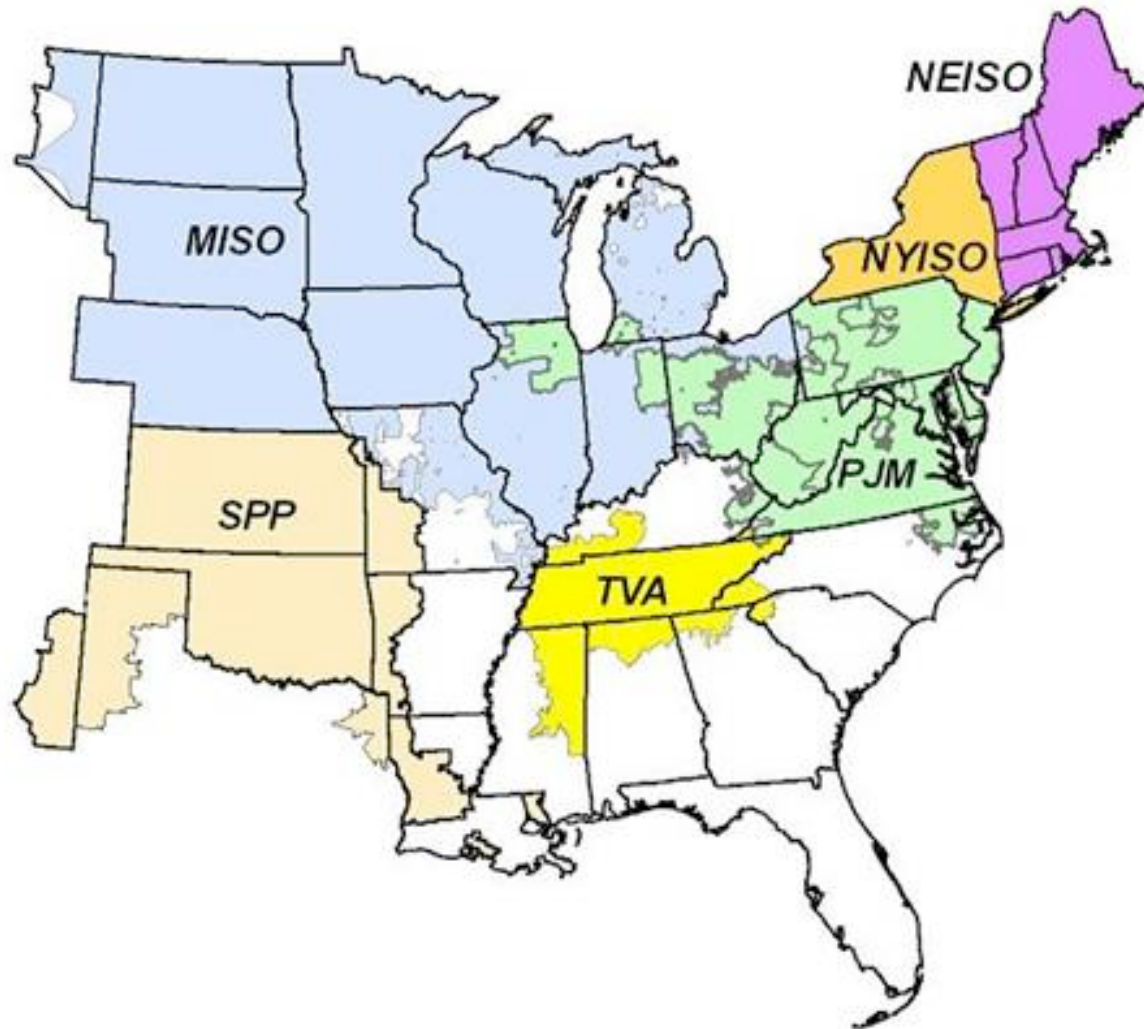


EASTERN WIND INTEGRATION AND TRANSMISSION STUDY

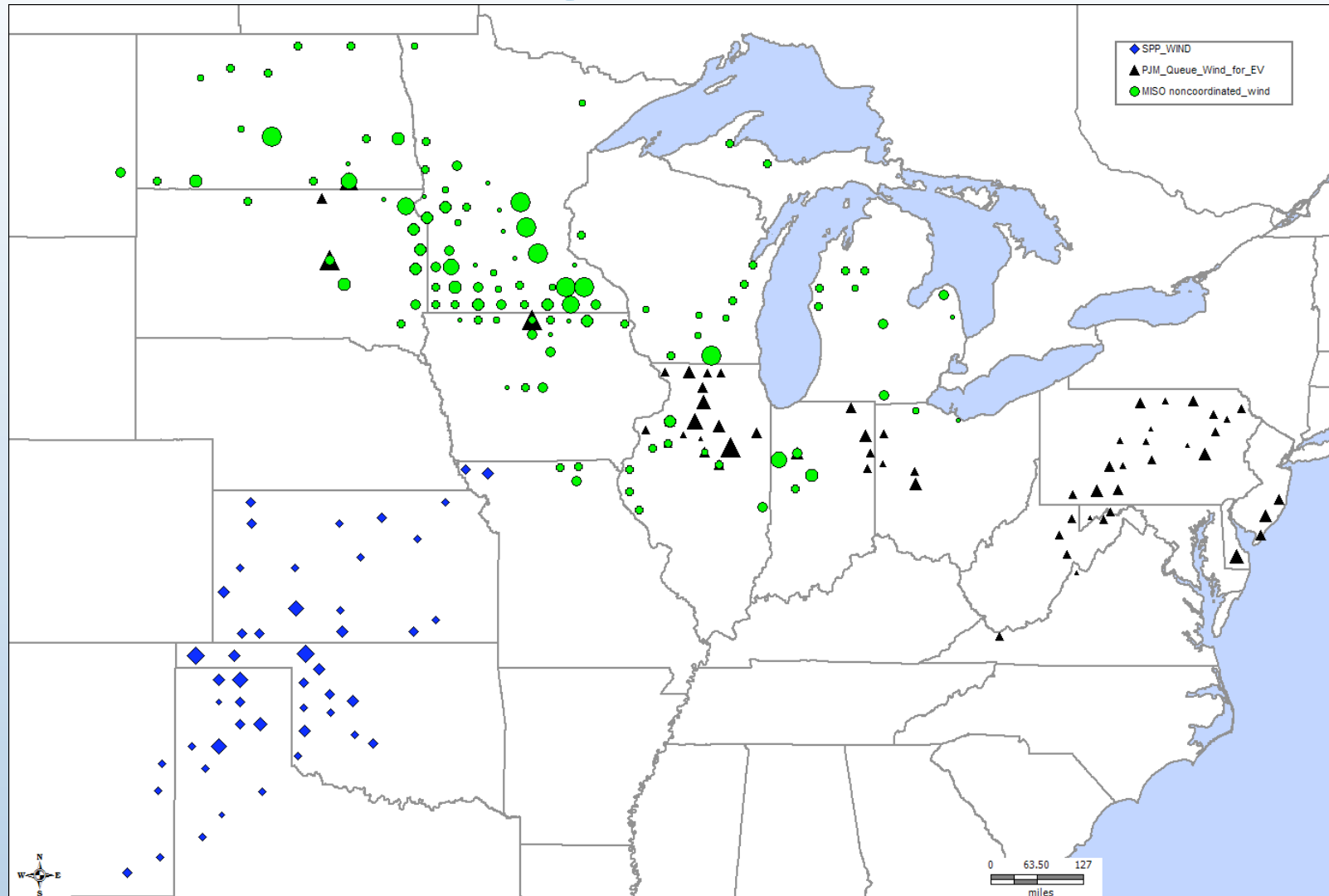
Eastern Wind Integration and Transmission Study (EWITS)

- Evaluate operating impacts for 20% and 30% wind energy penetration for the year 2024
 - Joint Coordinated System Plan (JCSP) study area includes (MISO/PJM/SPP/TVA /MAPP/NYISO/ISO-NE) and other interested parties
- Mesoscale modeling
- Transmission Study in conjunction with JCSP study
- Integration Study

Integration Study Area Footprint within the Eastern Interconnect

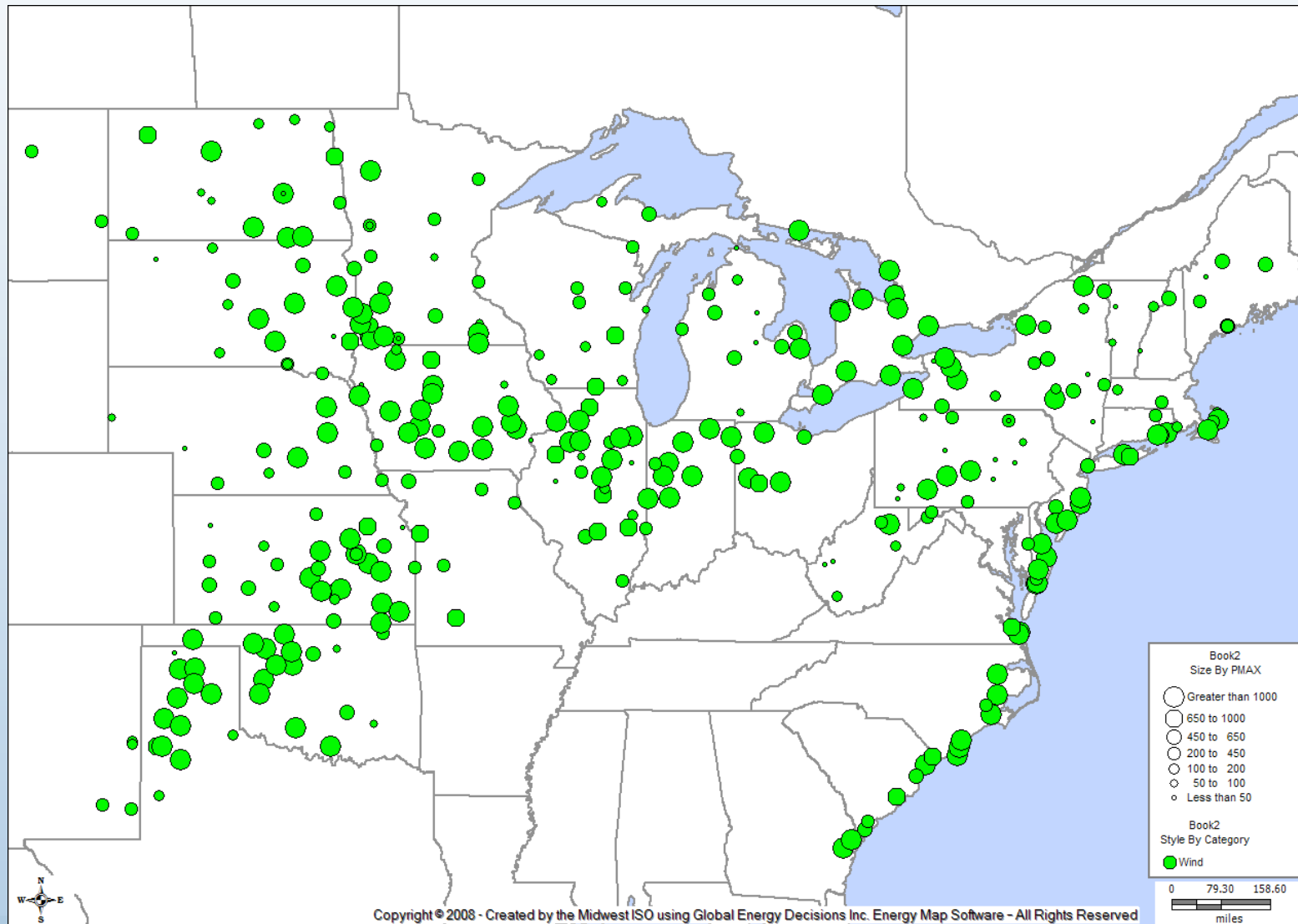


Existing Queue Data



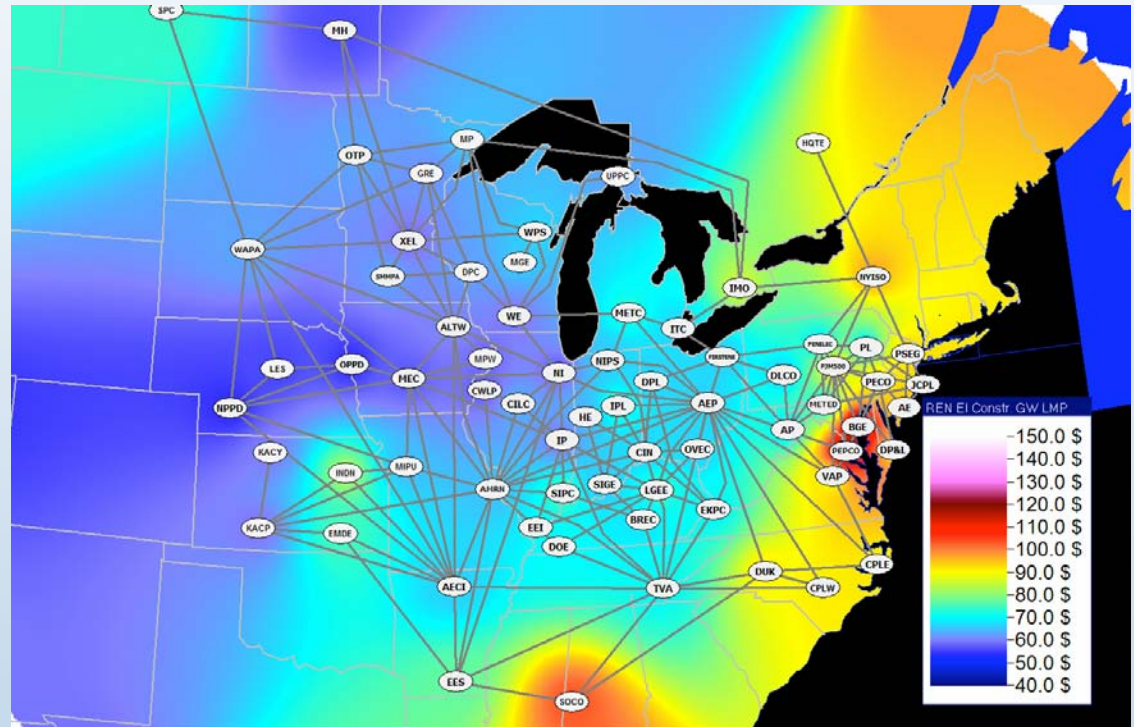
Preliminary Siting for the JCSP Study

20% Wind Energy Scenario



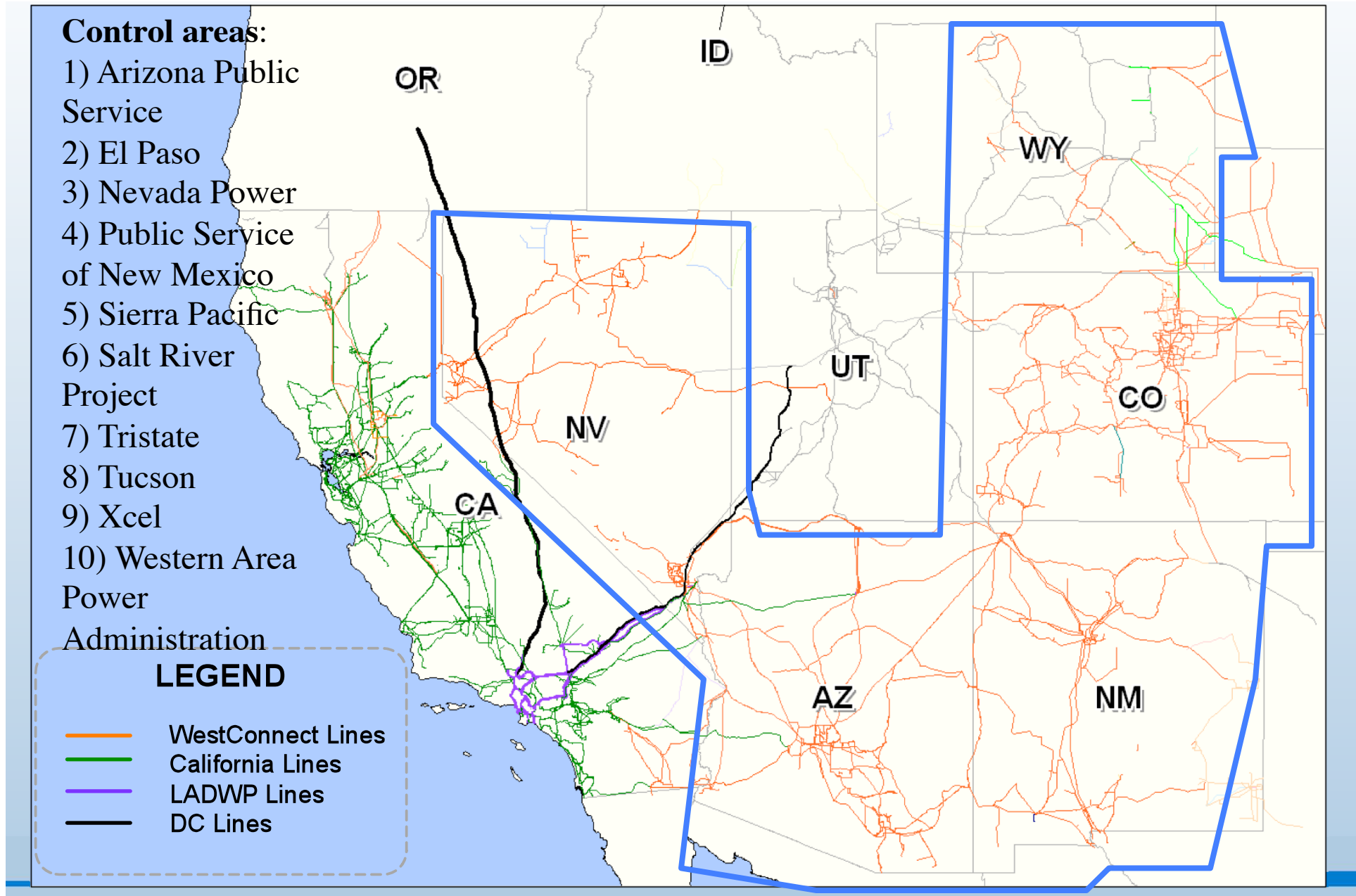
Key Tasks- Eastern Wind Integration & Transmission Study

- Develop transmission plan (coordinated with JCSP)
 - Run hourly production cost models



WESTERN WIND AND SOLAR INTEGRATION STUDY

Study Footprint (WestConnect outside of California)



Tasks and Schedule

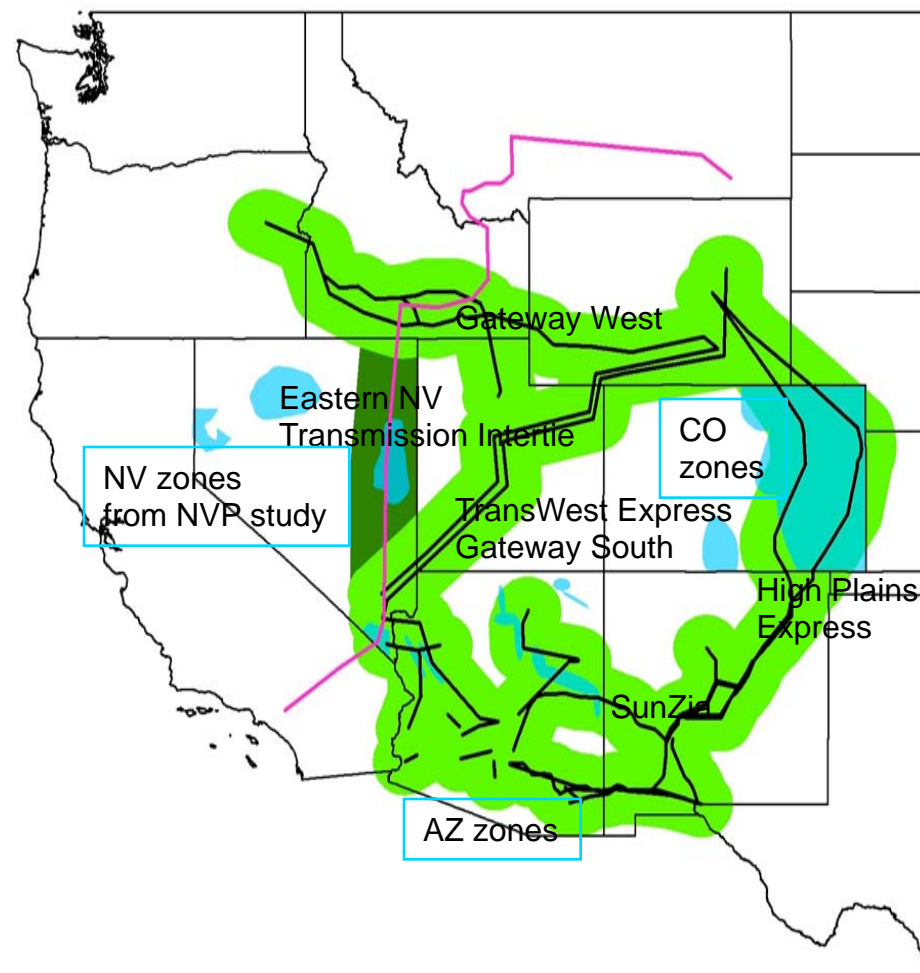
- Stakeholder Meeting (5/23/07)
- Data Collection (until 5/08)
 - Wind and solar mesoscale modeling (3TIER)
 - Utility load, generator, transmission data (Exeter)
- Preliminary Analysis (3-7/08) - GE
 - Extensive statistical analysis with various options for wind/solar sites and transmission
- Scenario Development (8/08) - GE
 - In-state vs out-of-state resources
 - Geographically diverse resources
 - Mega projects
 - Best correlated with load
- Stakeholder Meeting (8/14/08)
- Run Scenarios (starting 8/08) - GE
 - Examine costs due to regulation, load following, unit commitment
 - “Dives” to investigate issues such as Hoover
 - Examine mitigation strategies/options
 - Determine contributions to reliability and capacity value
- Preliminary Technical Results (end ‘08)
- Reporting and Stakeholder Meeting (mid ‘09)

High Renewables Basecase 2017

	Wind	Solar PV	Concentrating Solar Power	Total
Study footprint (WestConnect)	30% by energy	1.5%	3.5%	35%
	28,256 MW	2472 MW	2884 MW	33,613 MW
Rest of WECC	20%	0.9%	2.1%	23%
	36,767 MW	2895 MW	3378 MW	43,040 MW
Total	65,023 MW	5368 MW	6262 MW	76,654 MW

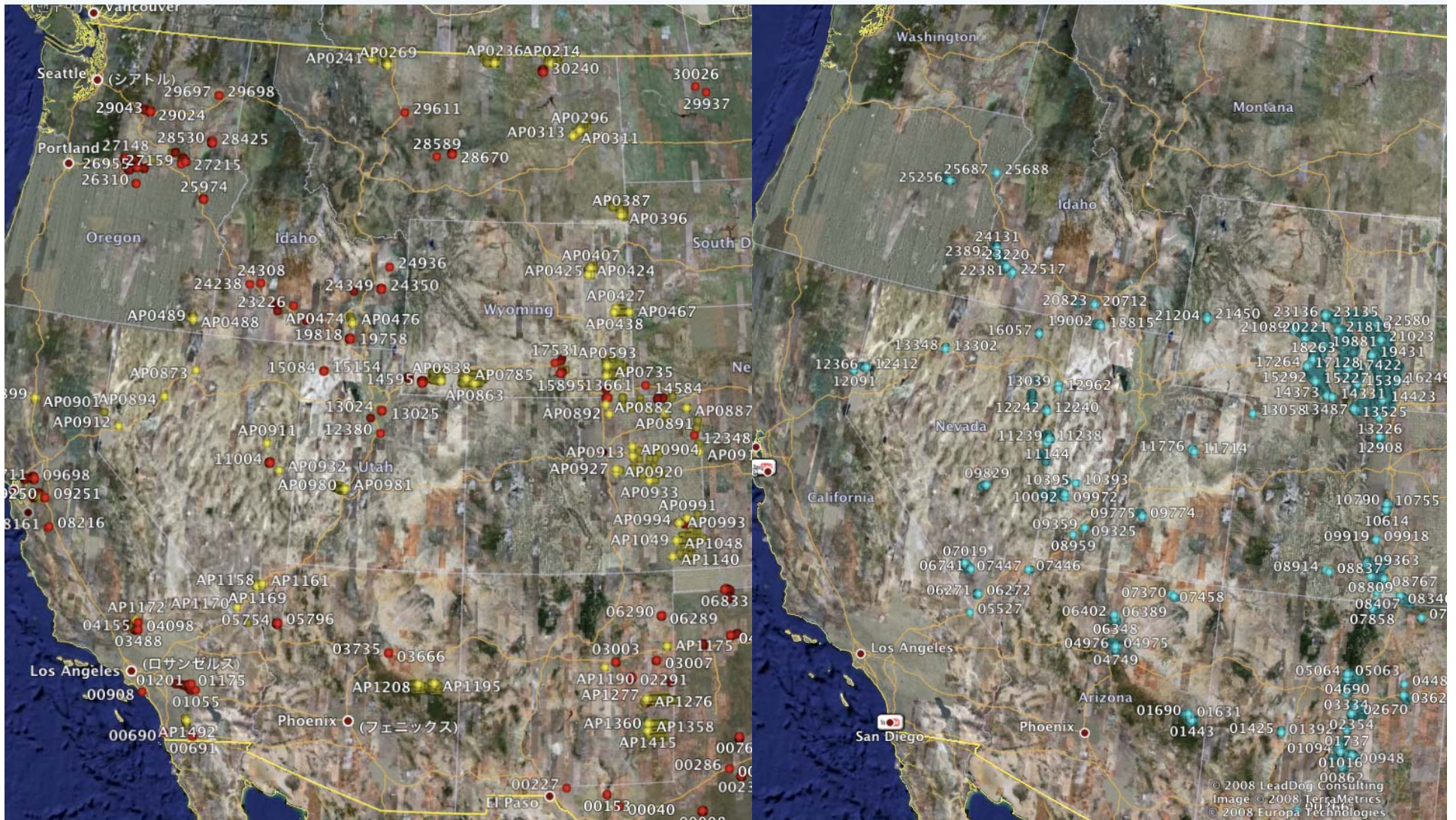
Wind Site Selection

- 3TIER downselected from 1.2M to 30,000 points. GE will select final sites.
 - Exclusions - recreation, urban, forests, slopes, high elevation, etc. (NREL)
 - Preselected sites - existing or planned wind plants (Platts database/NREL)
 - Transmission corridors or zones (200 GW) - based on proposed new transmission and initial zone information (excl new NV zones)
 - Load correlation (250 GW) - best diurnal correlation with Westconnect load
 - Best resource (450 GW) - best wind power density
 - Additional sites added in to help validate model results

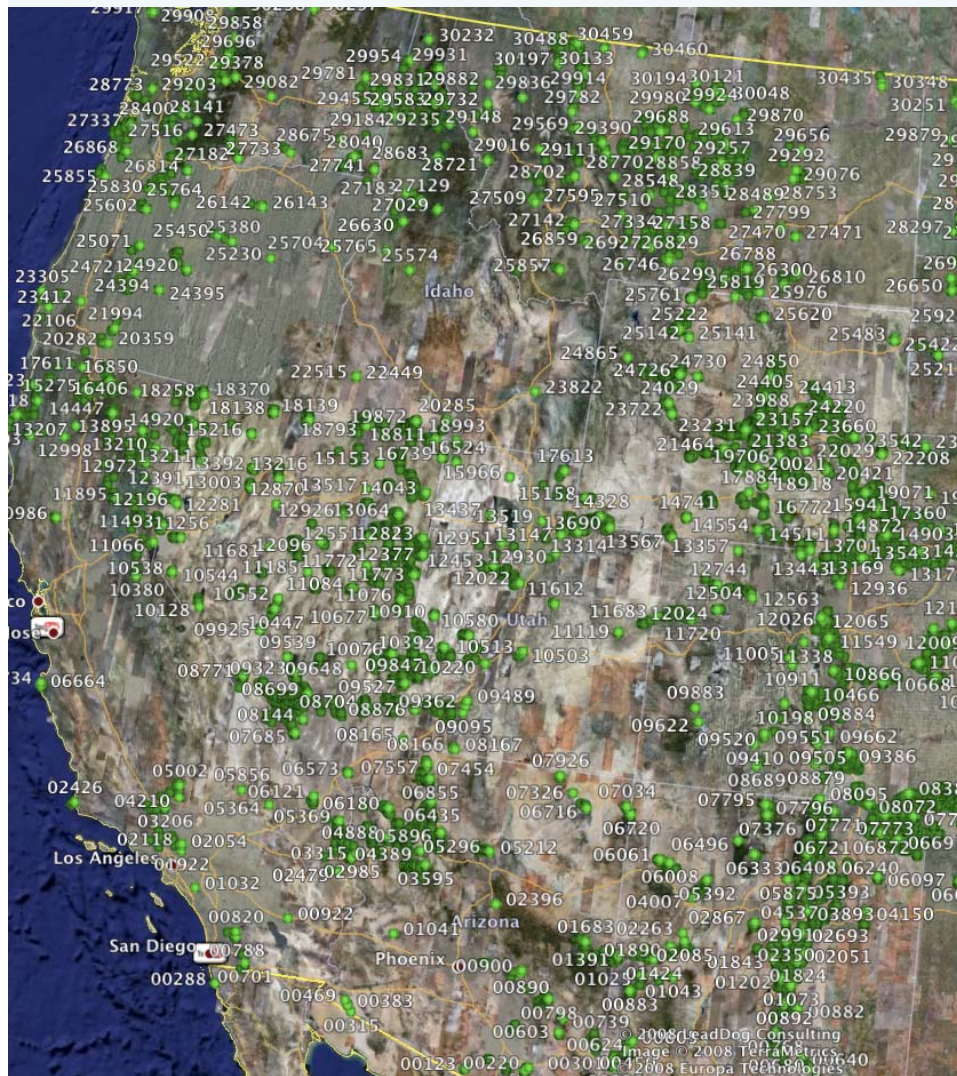


Preselected

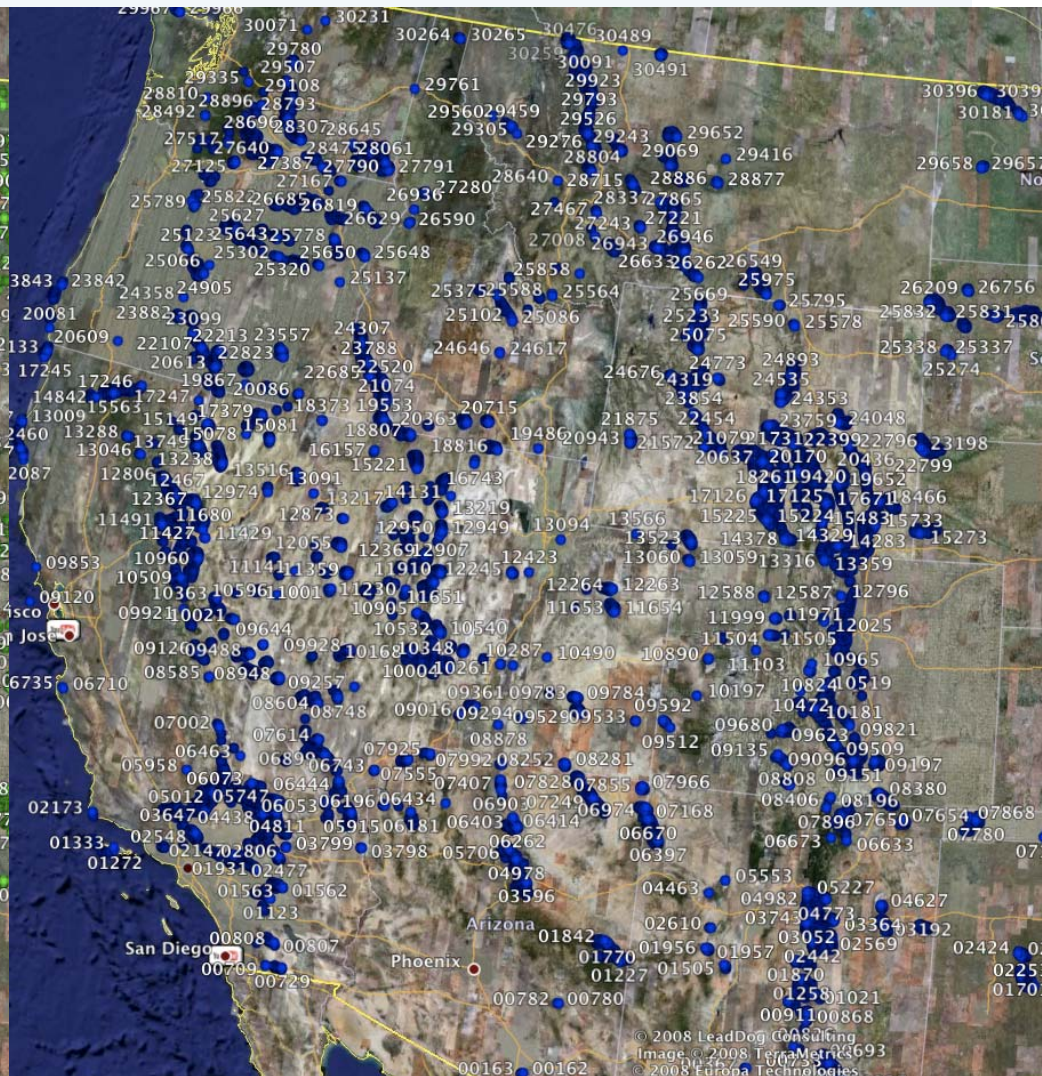
Transmission corridor/zone



Load correlated



Best resource



Solar Modeling

- Perez of SUNY ran solar model for US
 - 10km x 10 km grid
 - 1 hour intervals for 2004-2006
 - Direct normal and global insolation
 - Available at http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/
- PV Modeling
 - By weather station site (150 sites for western US)
 - Template of different orientations and tracking configurations
- Concentrating Solar Power (CSP) Modeling
 - Parabolic trough plants with 6 hours thermal molten salt storage, similar to APS Abengoa plant
 - Modeled over 200 GW of CSP sites
- Fast PV variations driving need for subhourly PV analysis

SUMMARY

Summary

- Wind mesomodel datasets will be publicly available later in 2008
- Work with existing utility processes (JCSP and WestConnect) crucial for relevance
- Stakeholder and Technical Review Committee process provide both education and buy-in
- Preliminary results later in 2008
- Final results in mid-2009

Contact Information

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